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## Stones and Endourology

### Original article

# Conservative management of colonic injury during percutaneous nephrolithotomy



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#### Abstract

**Objectives:** Colonic injury is a rare but serious complication of percutaneous renal surgery. Its clinical course may be elusive and an awareness of the various presentations is of great importance. We describe how early diagnosis and a diligent conservative approach have resulted in a favorable outcome in our series. **Patients and methods:** From 2005 to 2015, 2150 percutaneous nephrolithotomy (PNL) procedures were performed in our center. Patients' records were searched for the occurrence of colonic injury. Records were reviewed and we report on the preoperative data, the clinical presentation and the management approach in these cases.

**Results:** Three patients (0.14%) were identified with colonic injury following PNL, the three injuries were in male patients with a median age of 36.6 (range 28–45 years). Two injuries were on the left side and one on the right. Two of our patients had a low BMI. The renal puncture was in the lower posterior calyx in two and in the middle calyx in one. The diagnosis was established postoperatively in all and confirmed using antegrade or retrograde pyelography. All patients were managed conservatively with a favorable outcome.

**Conclusion:** An approach combining a high degree of suspicion for early diagnosis and a diligent conservative management results in a favorable outcome in patients with colonic injury during PNL.

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#### Introduction

Percutaneous nephrolithotomy is an established procedure for the management of renal stones [1]. Inadvertent colonic injury during the procedure is a rare, but grave complication with quite serious possible consequences varying from nephro-colonic or colocolutaneous fistula to abscess formation and up to peritonitis, sepsis and death [2]. Many studies have attributed such injuries either to the presence of a retro-renal colon, renal anomalies (such as horseshoe

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kidneys), chronic colonic distension in patients with prior intestinal bypass surgery, prior renal surgery or sometimes lateral origin of percutaneous renal punctures [3]. We reviewed our series of PNL in our tertiary care center and we report on the occurrence of colonic injury, possible risk factors and management.

### Patients and methods

From 2005 to 2015, a total of 2150 percutaneous nephrolithotomy procedures were performed. All procedures were performed by the authors, who had an experience of not less than 5 years in endourology at start of study. The procedure was performed under general anesthesia in the prone position with chest support, but with no bolsters under the upper abdomen, as we believe that this might push the colon into a more retroperitoneal position, especially in thin patients. A ureteric catheter was placed in the lithotomy position to opacify the system and the percutaneous renal access was established using biplane C-arm fluoroscopic guidance, through the appropriate calyx, medial to the posterior axillary line. A guide wire was then passed into the system and the tract dilated using first fascial then co-axial telescopic dilators. We identified three cases that were complicated with colonic injuries (0.14%). These patients' records were reviewed and a detailed description of the preoperative data, the clinical presentation and the mode of management are reported.

### Results

All of our patients with colonic injuries were males with a median age of 36.6 (range 28–45 yrs). Two injuries were on the left side and one on the right. Two of our patients had a low BMI. The renal puncture was in the lower posterior calyx in two and in the middle calyx in one. The diagnosis was established early postoperatively in all and confirmed using antegrade or retrograde pyelography. [Table 1](#) details the characteristics and perioperative features of these cases.

Management following confirmation of a transcolonic access was conservative and relied mainly on ensuring adequate drainage of the pelvicalyceal system, retracting the nephrostomy tube to act as a colonic tube when possible, intravenous broad spectrum antibiotics (with possible addition of coverage against anaerobic bacteria) and close monitoring (vital signs, repeat abdominal examinations and labs) for possible retroperitoneal leak or abscess formation that may necessitate surgical intervention.

In our first case with a supracostal transcolonic tube ([Fig. 1](#)), the tube was withdrawn into the colon and the second lower calyceal tube was left to decompress the system and drain the urine. Fever and tachycardia (maximum temperature 38.4 °C; pulse 102; BP 130/85) developed later that afternoon (second postoperative day) with mild elevation of total leucocytic count (TLC 15,000/mcL). Abdominal examination revealed a lax abdomen, but with localized tenderness in the right hypochondrium. A retroperitoneal collection was suspected, an artery forceps was used to dilate the track around the transcolonic tube and a penrose drain was placed by the side of the tube to drain the retroperitoneum. An abdominal ultrasonography revealed absence of any retroperitoneal collection. Clinical improvement occurred with resolution of tachycardia and TLC elevation, but hectic fever continued for 48 h (up to 38.2 °C). A repeat nephrostogram on the fifth postoperative day revealed resolution of reno-colic fistula and fever had subsided completely. The transcolonic tube was then downsized on alternate days to 18 F and then



**Figure 1** Antegrade pyelogram showing leakage of contrast filling the colon.

14 F and then removed. The colonic fistula resolved completely 48 h later. The patient was allowed to eat freely all through the postoperative period, apart from the initial 24-h after diagnosis of the fistula when the patient was unstable.

In our second patient, following confirmation of a transcolonic access on the second postoperative day, the nephrostomy tube was withdrawn into the colon and the ureteric catheter left in place to drain the pelvicalyceal system. An antidiarrheal agent was given to solidify the stools in the left colon and hence minimize the leakage of fluid stools from the colon to the kidney. The patient was kept on a regular diet and encouraged to eat bulky food. On the fourth postoperative day, the urine drained by the ureteric catheter changed from the light brown color secondary to fecal soiling to a clear color and a day later, a retrograde study confirmed resolution of the reno-colic fistula with an intact pelvicalyceal system. The colonic tube was then downsized on alternate days from 26 F to 20 F to 16 F and then finally removed. The patient did develop two bouts of fever up to 37.9 °C, but they were never persistent and resolved spontaneously. The rest of his vital signs (pulse 84, BP 120/70) and his TLC (8700/mcL) were within normal. A sonogram confirmed the absence of any retroperitoneal collection. The colonic fistula closed spontaneously two days after removal of the last tube and the patient was discharged 12 days postoperatively.

The diagnosis in our third patient was suspected due to the development of watery diarrhea following the removal of the nephrostomy tube and was confirmed by a retrograde study revealing a tiny fistulous tract between the lower calyx and the colon. The ureteric catheter was positioned in the renal pelvis for drainage and the patient was encouraged to eat bulky diet together with an antidiarrheal agent and with slight limitation of oral fluids to thirst. Ambulation was encouraged. The abdomen remained lax and non-tender and the patient was afebrile with stable vital signs and TLC of 9800/mcL. Gradual resolution of diarrhea was noticed over the following 3 days till complete stoppage and a repeat retrograde confirmed an intact pelvicalyceal system.

### Discussion

The number of reported cases in the literature regarding colonic injury during PNL is very small. Many series have tried to identify

**Table 1** Patients' characteristics and perioperative data.

Case	Age	Indication for PNL	BMI	Preop. imaging	PNL access	Nephrostomy tubes	Colonic injury suspected	Colonic injury confirmed
1	45	Right renal 1.5 cm lower calyceal stone	21.6	IVP showing a dense 1.5 cm stone in lower anterior calyx with acute pelvicalyceal angle	1st supracostal (above 12th rib) puncture into middle calyx at post axillary line. 2nd lower posterior calyceal puncture	2 tubes 22 Fr (one for each tract)	On postop. day 1: mild abdominal distension, sluggish intestinal sounds On postop. day 2: fecal soiling around the supracostal tube	Nephrostogram showing leakage of contrast around the tube to fill the ascending colon (Fig. 1)
2	28	Left renal 2 cm pelvic stone	20.7	KUB and CTUT showing a triangular left renal pelvic stone with mild hydronephrosis and very little perinephric fat	Lower posterior calyx	Nephrostomy tube 26 Fr	On postop. day 1: mild abdominal distension and mild diarrhea. On postop day 2: fecal soiling around the nephrostomy tube	Nephrostogram filling the pelvicalyceal system and leaking around the tube to draw the shadow of colonic haustrations
3	37	Left renal 3 cm pelvic stone	31	KUB and CTUT showing a 3 cm left renal pelvic stone with moderate hydronephrosis	Lower posterior calyx	Nephrostomy tube 26 Fr	On postop. day 1: watery diarrhea after removal of nephrostomy tube, with an unexplained rise in serum creatinine to 2.3 mg/dL	Creatinine measurement in fluid stools and retrograde study confirming a tiny fistulous tract between the lower calyx and the colon

risk factors, but the rarity of such a complication make these studies very scarce.

Retrorenal colon or posterolateral displacement of the colon is the most commonly implicated factor in colonic injury during PNL. The incidence of retrorenal colon has been reported to vary between 1 and 14% [4–6]. Retrorenal colon was found to be more common in prone than supine position [2,7]. Many studies found that retrorenal colon was more frequently found on the left side [2,7,8]. In our series, two patients with colonic injury underwent preoperative standard CT UT and no retrorenal colon was identified. El-Nahas et al. reported an association between colonic injury on the right side and the presence of risk factors such as horseshoe kidneys, prior renal surgery and prior intestinal bypass surgery [3]. Some found that retrorenal colon was more likely in females [5], while others stated that there was no sex predilection [4,7]. Traxer et al. also reported that retro-renal colon was more common in patients above 40 years of age [9]; the theory behind this might be due to relaxation of perirenal fascia with age or decreased perinephric fat with age [10].

Although preoperative abdominal CT in the prone position may identify the presence of a retrorenal colon, yet the rarity of such a complication, the risk of radiation exposure and the expense of such an investigation prohibit making such a study a routine. However,

it might be advisable to perform this investigation in previously mentioned high-risk groups such as patients with horseshoe kidneys, low BMI, prior renal surgery, or chronic colonic distension.

In our study, two of our patients had low normal BMI and in one patient little perinephric fat was noted on preoperative CT study. Given that our stone population undergoing PNL consists mostly of patients with either normal or elevated BMI, it does seem that low BMI/lack of perinephric fat may be a significant risk factor for colonic injury during PNL, and a high degree of awareness and suspicion should be raised in these patients.

Although in our series, colonic injury occurred with standard lower posterior calyx punctures in two cases, yet in one patient, we believe that a supracostal slightly lateral puncture flush at the posterior axillary line could have been a cause for such an injury. Many factors may be useful in avoiding puncture-related colonic injuries, these include more medial punctures, avoiding gas shadows during fluoroscopy guided punctures and readjusting needle or site of skin puncture when a distended colon is seen pushed by needle tip. Others have advocated ultrasound guided [11] or CT guided punctures [12] in high-risk patients.

As regards the management of these colonic injuries, the authors believe that early diagnosis is the most important step toward proper

management. We also believe that such early diagnosis requires primarily awareness of this complication and keeping a high degree of suspicion, as the presentation, as described in the different cases, is not always straightforward. An antegrade nephrostogram at the end of the procedure might help to identify the injury; however, it is not always conclusive, as was the case in our work where we failed to identify the injury despite doing such a study. We believe that this might be related to the fact that we prefer to inject contrast at very low pressure and that such injury might not be apparent except with high pressure contrast injection or with a non-dilated pelvicalyceal system.

Additionally, we believe that colonic injuries must be suspected in all patients with unexplained postoperative fever or in patients with altered bowel habits especially unexplained persistent diarrhea or abdominal distension. Hematochezia has also been reported by some studies [3]. The passage of gas or stools, whether through or around the nephrostomy tube, should be looked for carefully in such patients. Identification of a reno-colic fistula after removal of the nephrostomy tube might be possible with a retrograde study through the ureteric catheter, as reported in one case.

We believe that since most – if not all – colonic injuries during PNL are retroperitoneal, that conservative management should be the primary line of treatment. However, diligent monitoring of vital signs, total leucocytic count and regular abdominal examination is a must with early surgical intervention, if necessary to avoid potentially fatal complications. Ensuring both urinary and colonic drainage is vital in resolution of such a complication. We believe that the urinary system is usually best drained with a ureteric catheter, if still in place. Otherwise, if removed, an indwelling double pigtail stent should be positioned. Sometimes, if a double puncture was used during PNL, as in one of our cases, one of the two tubes, that is not transcolonic may be used for drainage.

We prefer to withdraw the transcolonic nephrostomy tube, if still in place, back into the colon to act as a colostomy. This is advocated by many other series [13,14]; other series prefer to withdraw the nephrostomy tube in the retroperitoneum outside the colon to act as a drain [3] and yet others prefer to remove it completely [15]. In some instances, as in one of our cases, persistent fever or localized collection around the nephrostomy in the retroperitoneum after it has been withdrawn into the colon, may be dealt with by dilating the tract around the tube under ultrasound guidance and placing a penrose drain by its side. In our series, none of the patients was diagnosed late; however, other groups reported the need of a colostomy in 40% of late colo-cutaneous fistulas.

Reno-colic fistula can heal spontaneously with only proper urinary drainage, as in one of our cases, where the fistula was diagnosed after removal of the nephrostomy tube, but not the ureteric catheter. We believe that dietary manipulations may help in healing of these fistulas, either by limiting fluid intake for a short period or by rendering stools more bulky and dry using antidiarrheal agents, especially with left-sided colonic injuries.

## Conclusion

Colonic injury is a rare complication during PNL. An approach combining a high degree of suspicion for early diagnosis and a diligent conservative management (ensuring adequate drainage of

the pelvicalyceal system, retracting the nephrostomy tube to act as a colonic tube, intravenous broad spectrum antibiotics, and dietary modification) results in a favorable outcome in patients with this complication.

## Consent

Consent from the patient/parents.

## Ethical committee approval

The study submitted for publication is an observational study based on retrospective review of patients' charts. According to institutional policy, this type of study does not require consent from patients and does not necessitate Ethical committee approval.

## Conflict of interest

None.

## Source of funding

None.

## Authors' contributions

Mohamed Elghoneimy: Inception of study idea, performance of PNL procedures, drafting the initial manuscript draft, and revision of final manuscript.

Mohamed Abdel-Rassoul: Planning of study design, performance of PNL procedures, performance of chart review and data collection, performance of statistical analysis, and revision of final manuscript.

Hany Elfayoumy: Sharing in planning of study design, performance of PNL procedures, performance of chart review and data collection, drafting the patients and methods section of the manuscript, and revision of final manuscript.

Ashraf Mosharafa: Sharing in planning of study design, performance of chart review and data collection, performance of PNL procedures, writing the final manuscript, and corresponding author (submission of manuscript; response to reviewers comments and drafting the revisions).

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